malcom

MALCOM PC-1TL VISCOMETER

INSTRUCTION MANUAL

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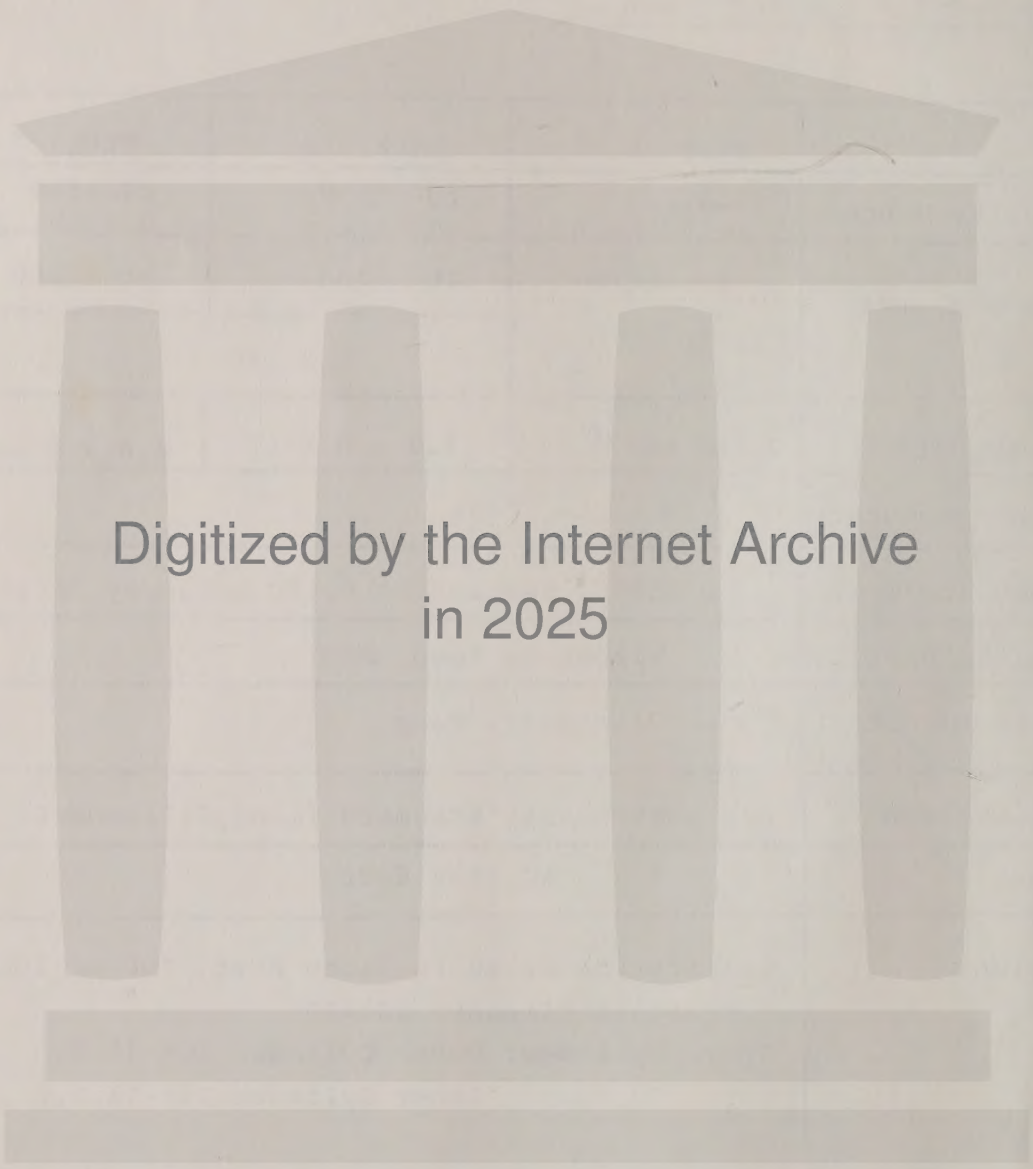
MP MASTER
MA29159

S P E C I F I C A T I O N

	TYPE A	TYPE B	TYPE C
Viscosity Range	10-1000 x 10^3 mPa.S	20- 1999 x10 mPa.S	20-1999 x 1 mPa.S
R P M (N)	3 - 100	10 - 100	10 - 100
	FIX 10	FIX 40	
Shear Rate D	0.6xN sec^{-1}	1.2 x N sec^{-1}	4.8 x N sec^{-1}
Repeat Accuracy	± 2%		
Measuring Temp	0 -50°C Resolution 0.1°C Accuracy ±0.2°C		
Digital Display	Viscosity Temp, RPM		
External Output	Viscosity, Temp		
Calibration	JIS Z29909-1987 Standard flued,SiliconKF96		
Power	AC 115V 60HZ		
Option	Calibration Flued :Silicon KF96 100 or 300CC Ultrasonic Cleaner: AUC-201 Spare Cylinder; Outer Cylinder ROM-1A,B,C Inner Cylinder RIM-1A,B,C PC-1TL Unit includes one(1) cylinder of either AB,or C. Other two(2) Cylinders are options.		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NOMENCLATURE

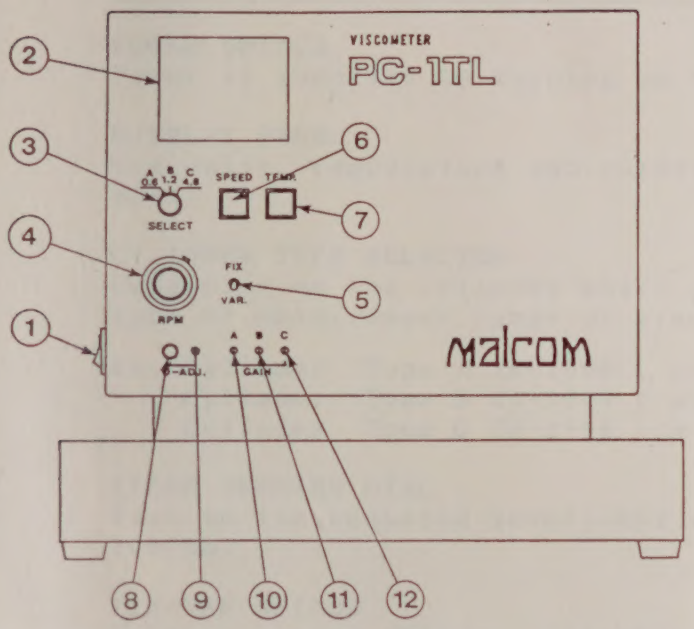


Fig. 1

1. POWER SWITCH
2. DISPLAY PANEL
3. CYLINDER TYPE SELECTOR
4. SPEED VERNIER DIAL
5. FIX-VAR SWITCH
6. SPEED BUTTON
7. TEMPERATURE BUTTON
8. 0-ADJ BUTTON
9. 0 ADJUSTMENT
10. A GAIN ADJUSTMENT
11. B GAIN ADJUSTMENT
12. C GAIN ADJUSTMENT

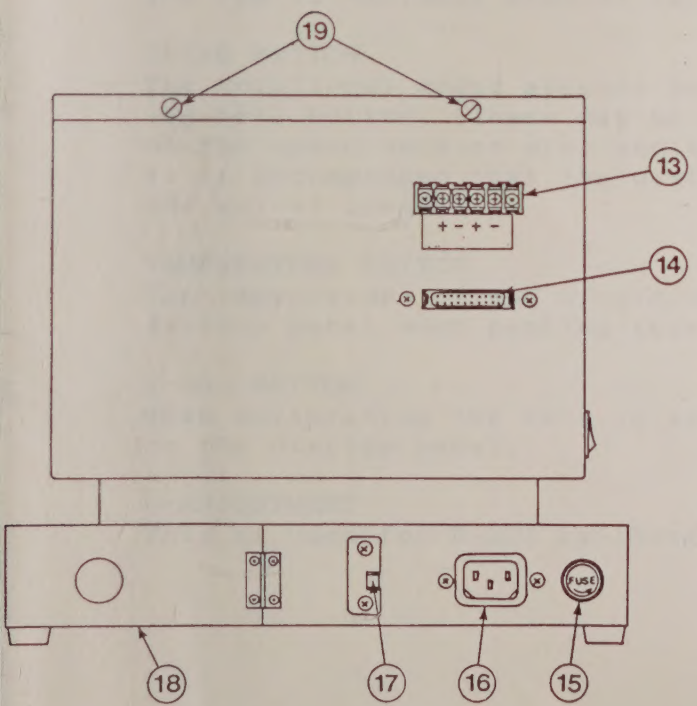


Fig.2

13. TERMINAL BLOCK
14. VS-3 CONNECTOR
15. FUSE
16. CONNECTOR FOR POWER CORD
17. SUPPLY VOLTAGE SWITCH
18. CYLINDER STORAGE
19. COVER SCREWS

FUNCTION

POWER SWITCH
Power is supplied by turning on this switch.

DISPLAY PANEL
Viscosity, temperature and rotational speed appear with each unit.

CYLINDER TYPE SELECTOR
Depending on the cylinder which you use, turn to the correct type of measurement range of viscosity.

Ex. Cylinder Type A 10-1000 ($x10^3$ mPa.S)
Cylinder Type B 20-1999 (x10 mPa.S)
Cylinder Type C 20-1999 (x 1 mPa.S)

SPEED VERNIER DIAL
Turn to the required rotational speed. The range is from 3 to 100rpm.

FIX-VAR SWITCH
Selects either FIXed or VARiable speed. The rpm is fixed in accordance to cylinder type when it is turned to FIX.

Ex. Type A: 10rpm (Shear Rate= 6.0 1/S)
Type B: 40rpm (Shear Rate= 48 1/S)
Type C: 40rpm (Shear Rate=192 1/S)

The rpm is variable when it is switched to VAR.

SPEED BUTTON
The rotational speed appears on the display panel when pushing this button. (There may be a difference between the numbers of the speed vernier dial and the display. In this situation it is recommended that the display panel value be considered the actual speed.)

TEMPERATURE BUTTON
The temperature of the liquid being measured appears on the display panel when pushing this button.

0-ADJ BUTTON
When calibrating the VS-3 to zero, push this button to verify on the display panel.

0-ADJUSTMENT
This is used for 0-ADJ calibration.

A. GAIN ADJUSTMENT
This is used for calibrating the controller with Type "A" cylinders.

B. GAIN ADJUSTMENT
This is used for calibrating the controller with Type "B" cylinders.

C. GAIN ADJUSTMENT
This is used for calibrating the controller with Type "C" cylinders.

TERMINAL BLOCK
External viscosity and temperature output
Ex. (Viscosity)
Type A: (1mV / $\times 10^3$ mPa.S)
Type B: (1mV / x10 mPa.S)
Type C: (1mV / x 1 mPa.S)

(Temperature)
(1mV /°C)

VS-3 CONNECTOR
This is to connect the cable from the VS-3 and controller.

FUSE
Use 1A type only.

CONNECTOR FOR POWER CORD

SUPPLY VOLTAGE SWITCH
This is used to select the supply voltage for the controller.

Supply voltage(AC V)	Range of voltage(AC V)	Fuse(A)
100	90-110	1
115	104-126	1

The switch is locked at 115 V AC at the Factory

CYLINDER STORAGE
Cylinders can be placed in this compartment when they are not in use.

COVER SCREWS
The storage compartment for the VS-3 can be accessed by removing these screws.

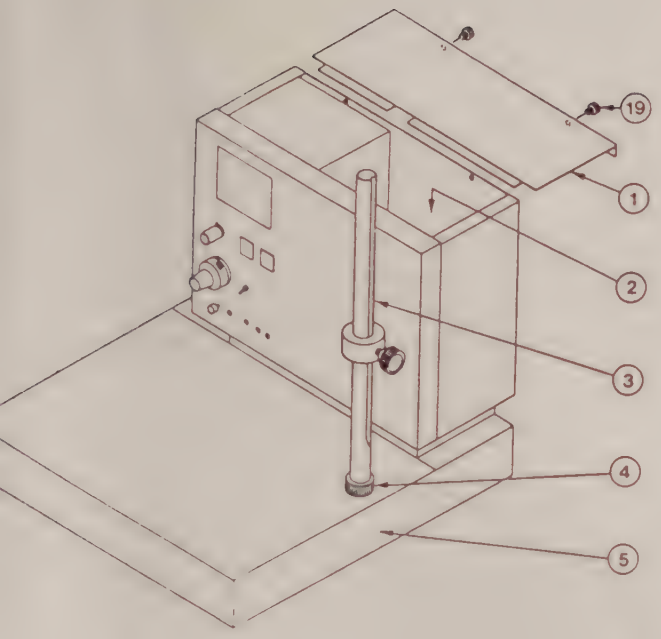


Fig.3

Fig. 3
1. COVER
2. STORAGE FOR VS-3
3. SUPPORT SHAFT(WITH COLLAR)
4. SUPPORT SHAFTLOCK NUT
5. CONTROLLER BASE
19. COVER SCREW

Fig. 4
1. SERIAL NUMBER
2. INNER CYLINDER
3. OUTER CYLINDER
4. CONTROLLER CONNECTOR
5. TEMPERATURE SENSOR REST
6. TEMPERATURE SENSOR
7. TEMPERATURE SENSOR LOCK SCREW
8. TEMPERATURE SENSOR STOPPER
(VS-3 MOUNT NOT SHOWN)

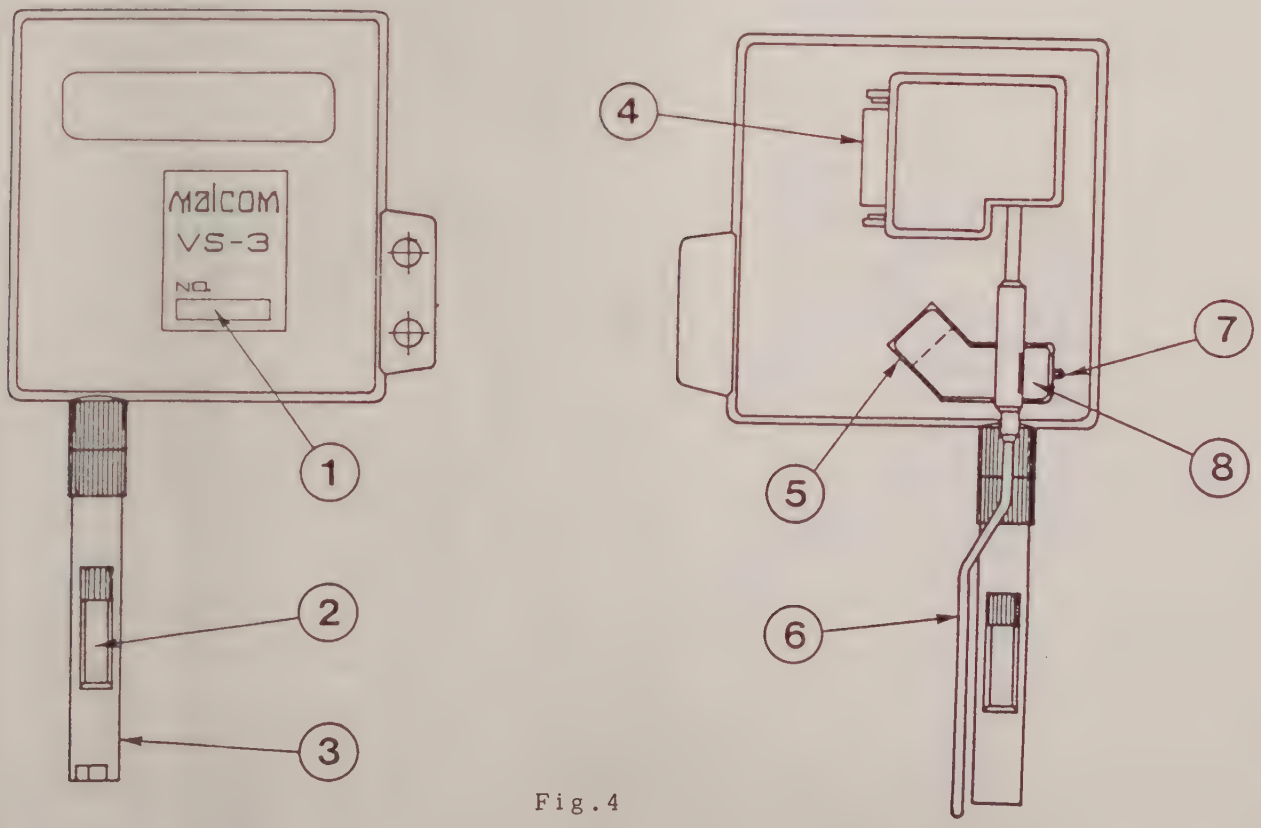


Fig.4

S E T T I N G U P T H E V S - 3

Remove the cover screws and cover and take out the VS-3 from the storage compartment of the PC-1TL controller. Assemble the VS-3 and mount. See Fig. a . Loosen the temperature sensor lock screw and position the temperature sensor into the sensor. See Fig. b.

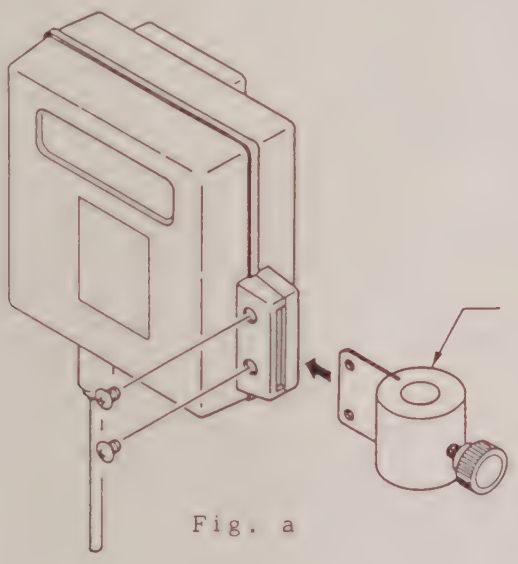


Fig. a

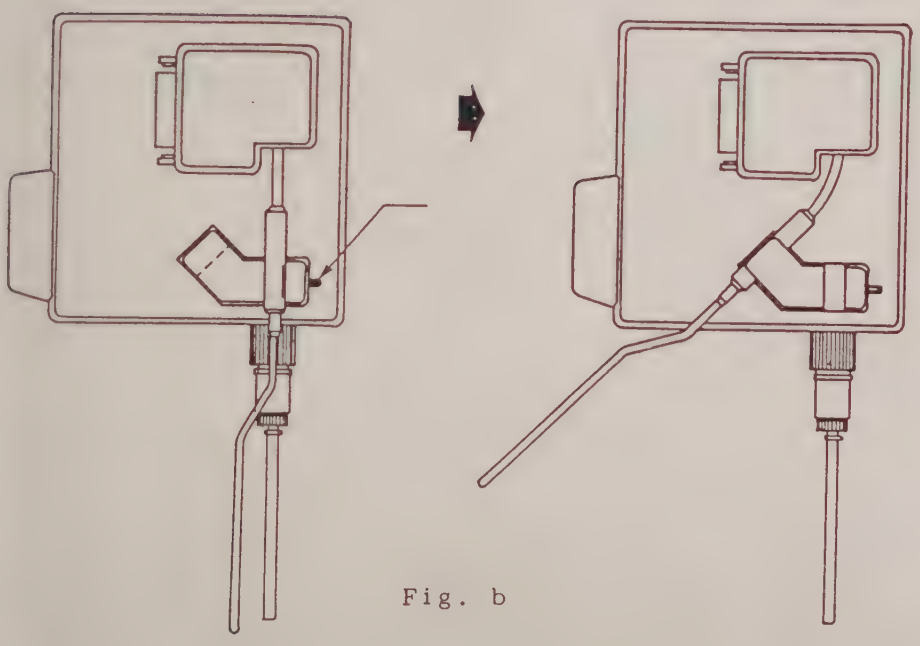


Fig. b

Thread the support shaft into the controller base. Position the "V" notch of the support shaft opposite the front left corner or the controller base. Secure with the support shaft lock nut. Slide the VS-3 over the support shaft and afix its position on the collar by tightening the mount screw. (See Fig.C)

Connect the VS-3 and controller with the connecting cable(50cm).

Should the VS-3 need to be repositioned, loosen the mount screw and support shaft lock nut and align as necessary.

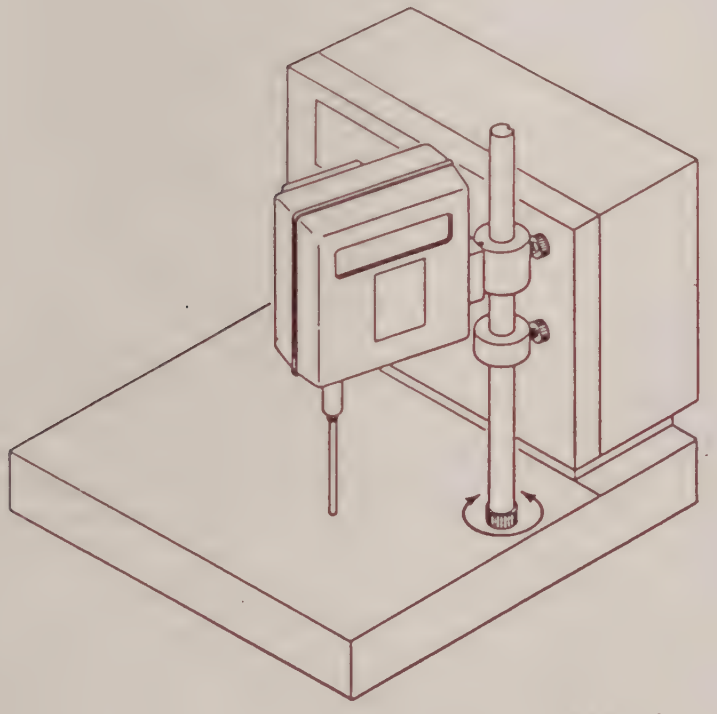


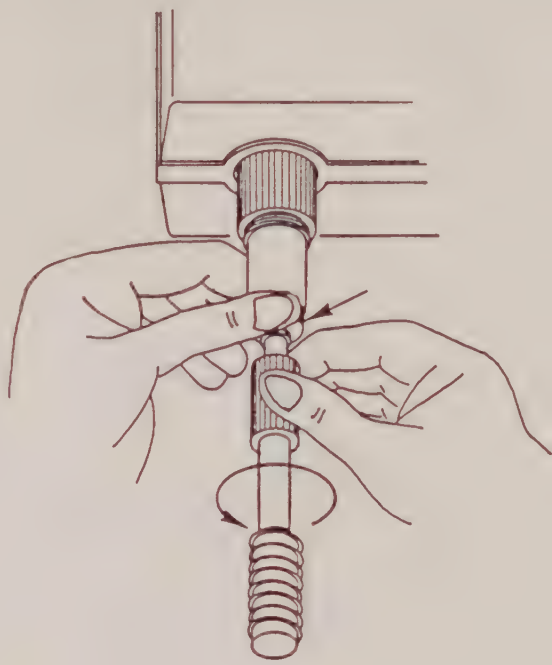
Fig. C

INSTALLING THE CYLINDERS

Type A Cylinder

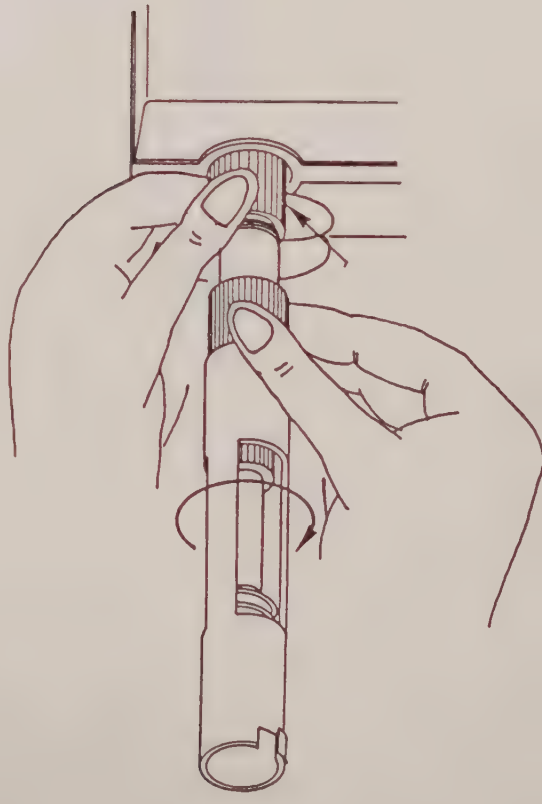
Installing the inner cylinder.
Hold but do not torque the small knurled collar on the shaft. Slide the inner cylinder up the shaft to the collar and turn counterlockwise. Do not apply any torque to do this.

Installing the outer cylinder.
Hold the upper knurled end of the shaft. Slide the outer cylinder over the inner cylinder and turn clockwise. Make this less than finger tight.



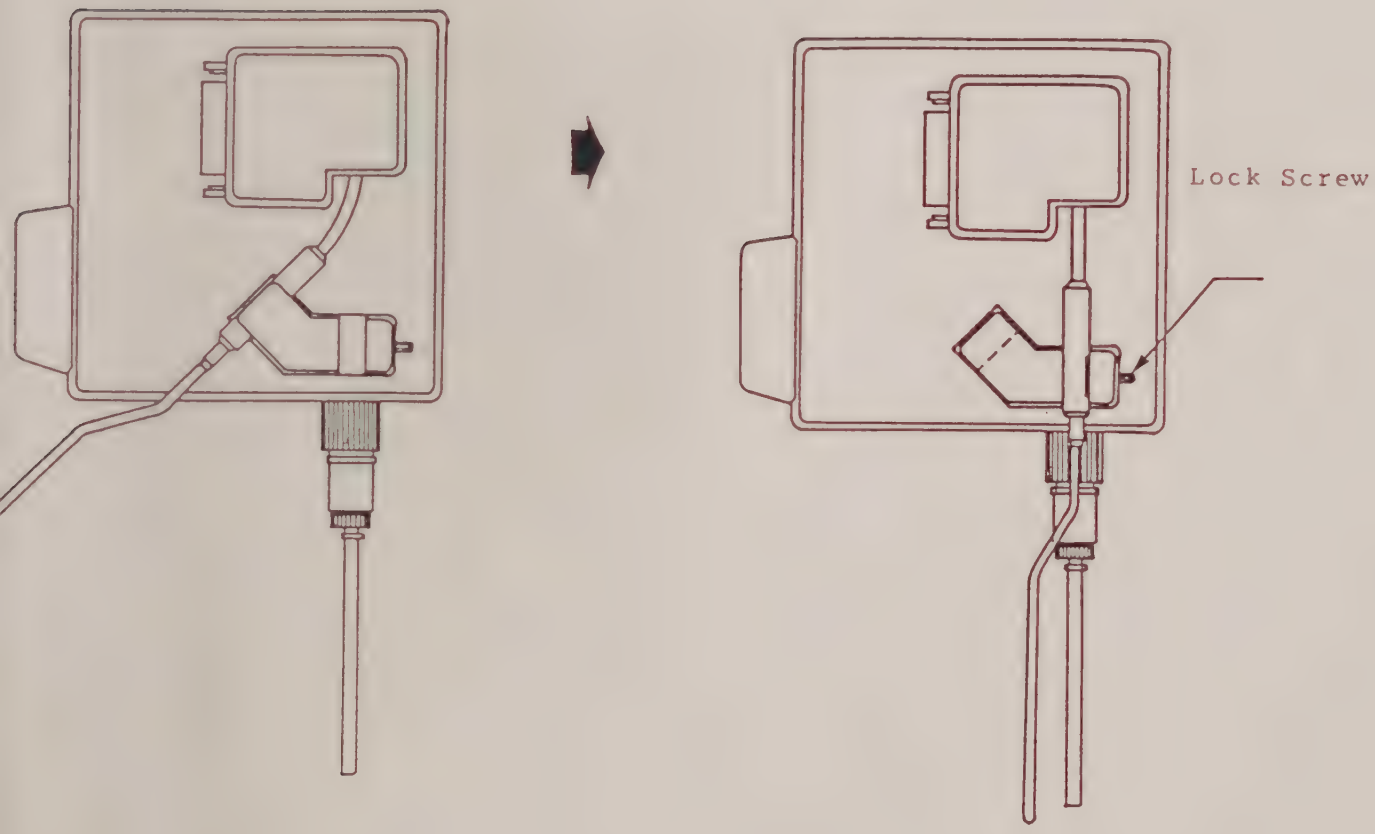
Type B Cylinder, Type C Cylinder

Installing B and C type cylinders.
Set the inner cylinder in to the cylinder first, then slide them together over the shaft. Tighten the inner and outer cylinders according to the above procedures.



POSITIONING THE TEMPERATURE SENSOR

Remove the temperature sensor from the sensor rest and set it 5 mm away from and parallel to the cylinders. Tighten the temperature sensor lock screw.



CONNECTING TO THE POWER SUPPLY

Before connecting your PC-1TL to the power receptacle, check that the voltage is correct. The required voltage for your PC-1TL is shown on the label at the back of the controller base.

Connect the power cord to your PC-1TL. Plug the power cord into a properly grounded receptacle.

Switch on the power.

Turn the cylinder type selector to the type which you are going to use.

Type A	Cylinder	10-1000	10^3	mPa S
Type B	Cylinder	20-1999	10	mPa S
Type C	Cylinder	20-1999	1	mPa S

Center a container of liquid to be measured under the VS-3.

Immerse the cylinders into the liquid as shown in Fig. F. For the A Type, the cylinders should extend no further out of the liquid than the diagram indicates. The positioning of the B and C Type cylinders is ideal. The lower lip of the exhaust port should be at or just below the liquid surface.

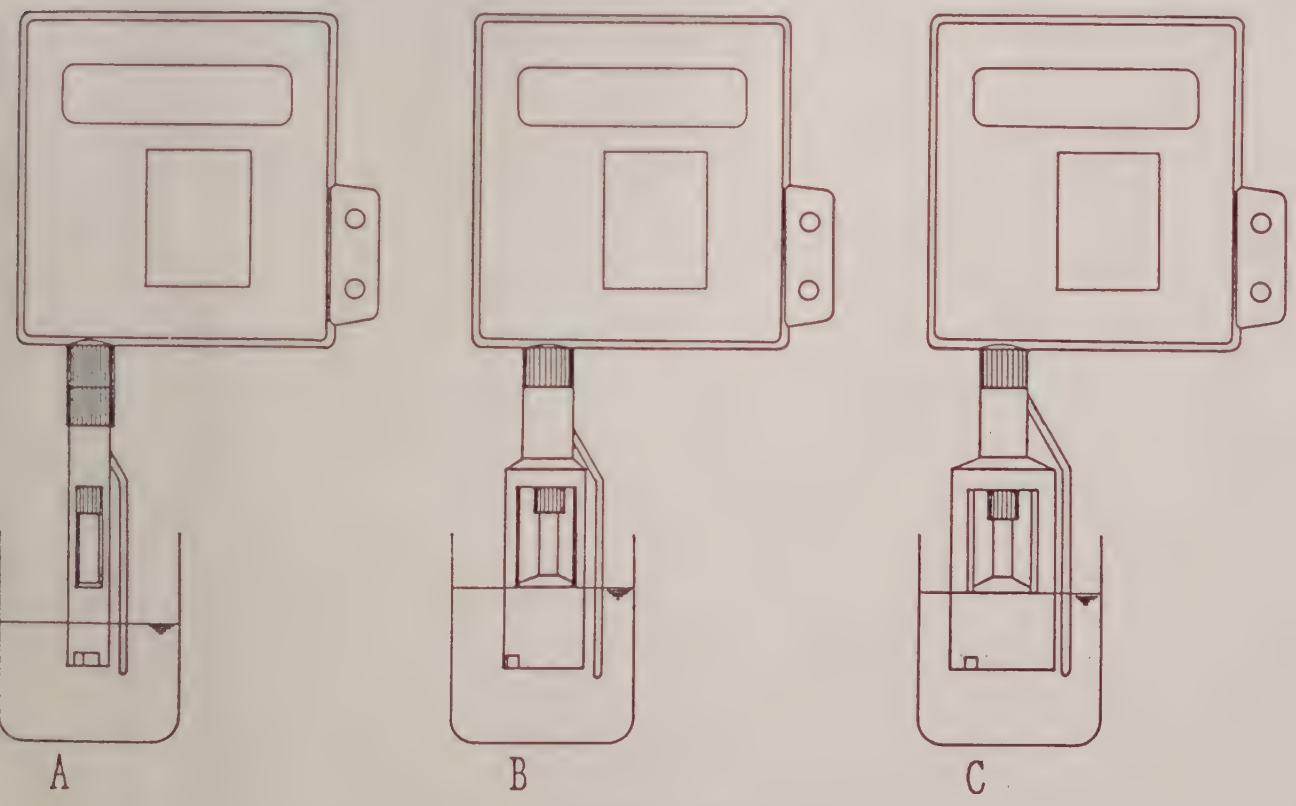


Fig. F

Shear rate (D) is a function of the rotational speed.
When you desire to change the shear rate, turn the FIX-VAR Switch to VAR.

Turn the Speed Vernier Dial to the required rpm.

While observing the display panel of the controller, push the Speed Button and fine adjust the vernier dial to the actual rpm.

The relation between rpm and shear rate is dependent of the cylinder type.

Cylinder Type	When rpm is N	When rpm is FIX
A	D=0.6N (1/ sec)	D=0.6 10= 6(1/ sec)
B	D=1.2N (1/ sec)	D=1.2 40= 48(1/ sec)
C	D=4.8N (1/ sec)	D=4.8 40= 192(1/ sec)

For measuring accuracy, we recommend not to use the PC-1TL at less than 5rpm for cylinder Type A, and less than 20rpm for cylinder Type B or C.
This is due to the difficulty of pumping the liquid between the cylinders at low rpm.

HOW TO CLEAN CYLINDER

Clean the inner and outer cylinders immediately after every use. Failure to do so may cause the cylinders to adhere together and become inseparable.

Using a small spatula helps to remove the liquid from the cylinders.

Type A Cylinder
Hold the upper knurled end of the shaft. Loosen the outer cylinder by twisting the knurled area counter clock wise. See Fig. G.
Slide the outer cylinder down off of the inner cylinder.

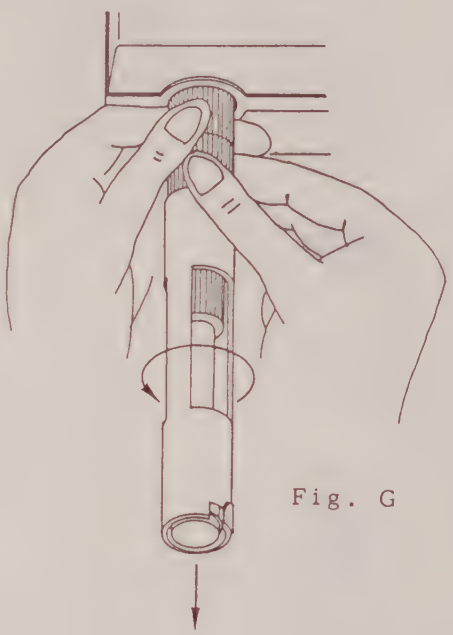


Fig. G

Hold but do not torque the small knurled collar. Grasp the knurling of the inner cylinder and rotate clockwise. Slide the inner cylinder down off the shaft.
See Fig. H.
It should require minimal or no torque at all to remove the inner cylinder.

Clean the shaft of the VS-3 with tissue or toilet paper.

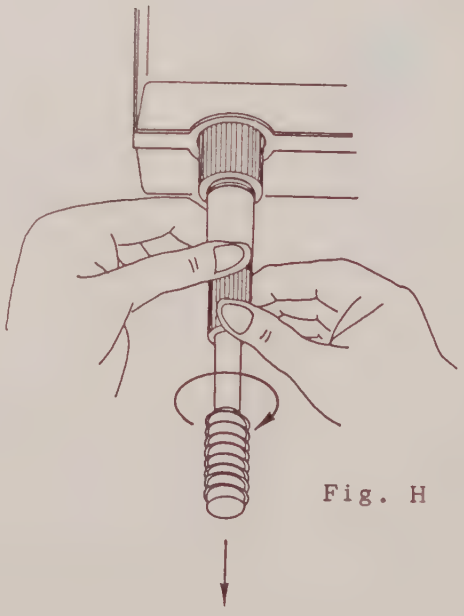


Fig. H

(Type B Cylinder & Type C Cylinder)

Hold the upper knurled end of the shaft. Loosen the outer cylinder by twisting the knurled area counter clockwise. See Fig. I. The outer cylinder can drop down and rest on the inner cylinder.

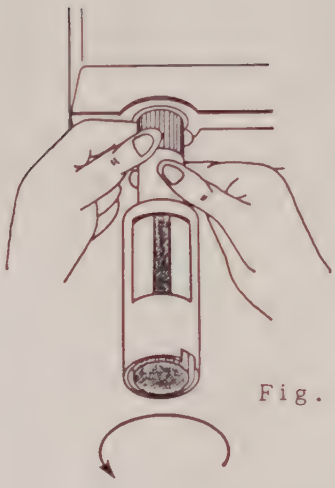


Fig. I

Hold but do not torque the small knurled collar. Grasp the knurling of the inner cylinder and rotate clock wise, slide both inner and outer cylinders down off the shaft together. See Fig. J. It should require minnimal or no torque at all to remove the inner cylinder.

Clean the shaft of the VS-3 with tissue or toilet paper.

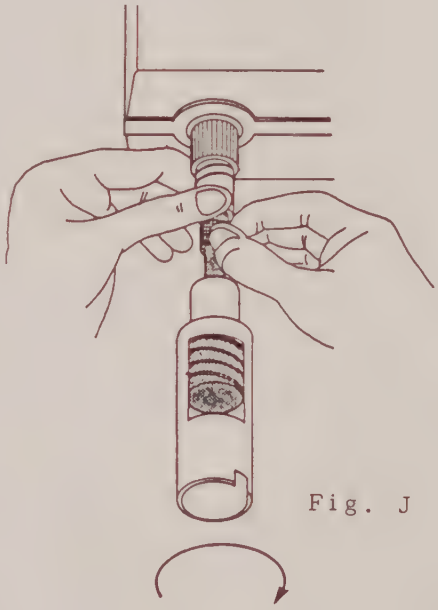


Fig. J

Wash the cylinders in a solvent to completely remove the liquid residue. An ultrasonic cleaner is recommended for thorough cleaning.

TROUBLESHOOTING

Should you encounter difficulties with your PC-1TL during the course of it's operation, please consult the following chart before calling your dealer for assistance.

If problems with your PC-1TL still occur even after checking the following chart, contact your dealer for service or repair.

TROUBLE	CAUSE	SOLUTION
A. Display does not illuminate when power is turned on.	Blown fuse	Replace fuse (1A fuse)
B. VS-3 cylinder does not rotate. (power is applied)	Blown fuse	Replace fuse (1A fuse)
	VS-3 cable disconected.	Make sure connection is good.
	Cable is shorted/ open.	Check cable pin continuity.
C. Unusual digital display.(cylinder is turning)		
1. 1999 Flashing	Cable is shorted/ open.	Check cable pin continuity.
	Over torque/ over range.	Out of range.
	Too high viscosity.	Verify correct speed.
	Contaminated bearing	Clean and lubricate.
2. Constant 0	Cable is shorted/ open.	Check cable pin continuity.
	Too low viscosity.	Change to B or C cylinder.

TROUBLE	CAUSE	SOLUTION
3. Unreasonable fluctuation.	Contaminated bearing.	Clean and lubricate.
	Object between inner and outer cylinder.	Remove object.
	Outer cylinder wobbling.	Return for repair.
	shaft bent.	Return for repair.
4. Values without sample.	Contaminated bearing.	Clean and lubricate.
	Loss of Accuracy.	Recalibrate.
D. Fluctuation in measurement.		
1. Air entrapment.	Bubbles in paste.	Remove bubbles and retest.
2. Sample has not been expelled.	Cavitation in sample container.	Oscillate sample container.
3. When changing RPM.	Shear rate is transient.	Switch to fix.
4. Temperature unstable.	Sample is too small.	Provide larger sample.
	Large difference of sample temperature and room temperature.	Minimize temperature difference.

C A L I B R A T I O N

Your PC-1TL was calibrated before it was shipped from the factory. However, when the VS-3 is replaced or when optional cylinders are to be used, the controller must be recalibrated. In due course, the PC-1TL may lose accuracy, at this time recalibration is necessary.

0-ADJ(Zero Adjustment)
Switch on the power. Do not have any loading on the VS-3.
See Fig. K.

Turn the Cylinder Type Selector to the "A 0.6" position.

Flip the FIX-VAR Switch to FIX.

Push the 0-ADJ Button and see if the Display Panel shows 0.

If it doesn't, turn the 0-Adjustment to get 0, while pushing the 0-ADJ button.

Turn the Cylinder Type Selector to B and see if it shows 0 on the display panel while the 0-ADJ button is pressed.

If it doesn't, turn the 0-Adjustment to get 0 while pushing the 0-ADJ button.

Repeat this procedure for C.

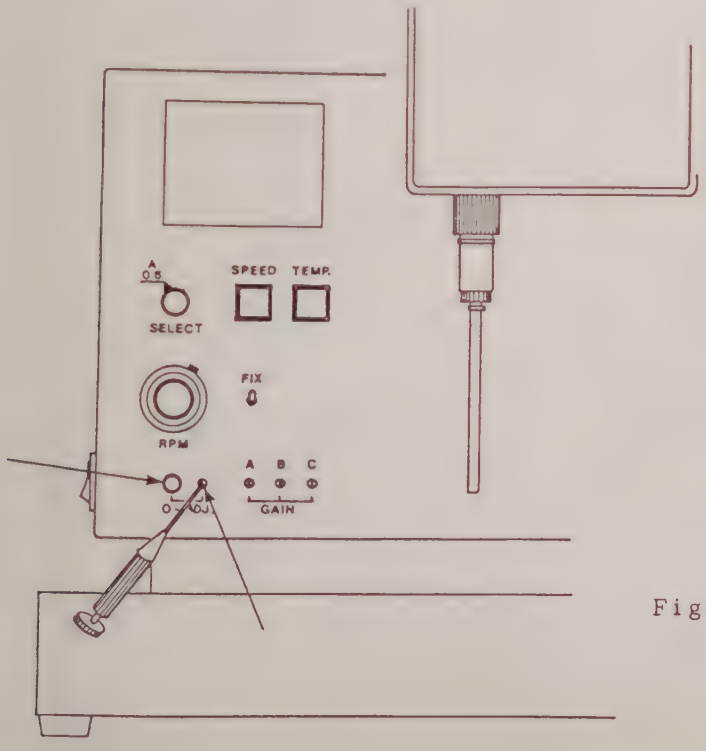


Fig. K

GAIN ADJUSTMENT (Type A Cylinder)

Prepare the following.
Calibration liquid KF96H 100,000 (Option).
Water bath with thermostat.

Partially immerse the calibration liquid into the water bath set at a constant 25°C.

Install the A Type inner and outer cylinders to the VS-3.

Turn the Cylinder Type Selector to "A 0.6"

Flip the FIX-VAR Switch to FIX.

Immerse the cylinder into the calibration liquid. The lower lip of the exhaust port of the outer cylinder should come down to the surface of the liquid as near as possible.

Turn on the PC-1TL and let it run for five minutes. Push the temperature button to verify that the calibration fluid is at 25°C. Compare the values of viscosity on the display panel and that printed on the jar of calibration fluid. If there is a difference, turn the A Gain Adjustment so that the viscosity in the display panel is identical to that printed on the jar. See Fig. L. Wait another five minutes and then repeat.

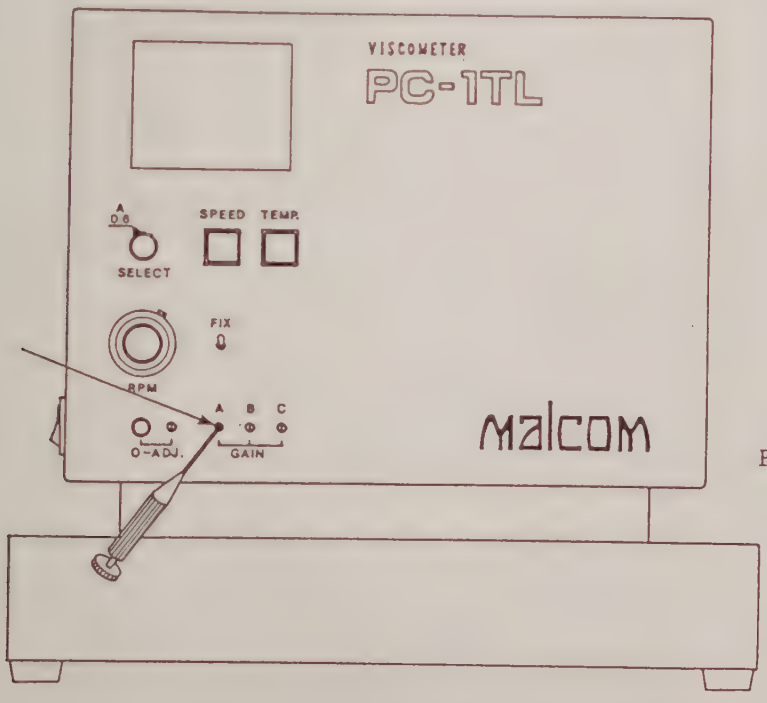


Fig. L

GAIN ADJ (Type B Cylinder)

Prepare the Calibration Liquid for Type B, KF96H 10,000(Option) and water bath with thermostat.

The procedure is the same as for Type A.

GAIN ADJ (Type C Cylinder)

Prepare the calibration liquid for Type C, KF96H 1000(Option) and water bath with thermostat.

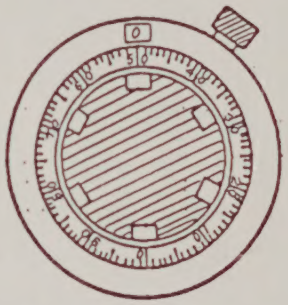
The procedure is the same as for Type A.

ADDENDUM TO MALCOM VISCOMETER INSTRUCTION MANUALS

The operation of the SPEED VERNIER DIAL and the proper choice of cleaning solvents.

The speed vernier dial enables the user to set the rotational speed of the outer cylinder. In the case of the PC-1T_ models, the FIX/VAR switch must be in the VAR position.

The speed vernier dial is simple in construction; a black knob attached to a graduated dial, numbered by tens from Ø to 1ØØ with tic marks every two units. Above the dial is a window where numbers indicate full revolutions of the knob. Now even though the dial indicates 1Ø, 2Ø,..., 9Ø, these numbers represent 1, 2,..., 9 RPM. A value of one tenth. Inversely, the window indicates tens of RPM. So 1 means 1Ø RPM, 2 means 2Ø RPM, and so on. To clear this up, see the below diagrams.



In the first example, the window shows 2 and the dial indicates 3Ø. This should be interpreted as 2Ø RPM + 3 RPM = 23 RPM. The second example shows Ø in the window and 5Ø on the dial. This would be Ø RPM + 5 RPM = 5 RPM.

If you are already familiar with vernier dials, you have noticed that the actual RPM is one tenth of what would be read. Going back to the first example; 2 and 3Ø make 23Ø, that divided by ten is 23 RPM. Likewise; Ø and 5Ø make Ø5Ø or 5Ø, and that divided by ten is 5 RPM.

The lever on the right side of the speed vernier dial is a friction lock and is not normally used. It should be kept in the up, loose position.

When cleaning the inner and outer cylinders, a solvent is recommended. However, this solvent should be mild, like iso-propyl alcohol or paint thinner. Harsher solvents can dissolve epoxies used in the construction of viscometer components, rendering them inoperatable. Use of these solvents, such as acetone, toluene or flux remover, will void the warranty.

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